

# The Resurgence of the U.S. Swordfish Market

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## Introduction

Once avoided by consumers because of mercury contamination, the swordfish, *Xiphias gladius*, is today making a comeback. As fears about contamination have waned and the trend toward more "upscale" seafood products has grown, the demand for swordfish has risen. But this resurgence has brought marked shifts in the swordfish market. Today, U.S. landings supply about 52 percent of consumption, compared with 13 percent in 1970. Continued growth in demand, however, may mean a return to a larger share for imports.

This paper will attempt to explain the current trends in the U.S. swordfish market and to project changes to 1995. To understand how the discovery of mercury contamination affected the swordfish market, historical trends are examined from 1965 to 1985. Using this time period, a regression model is used to estimate the demand for swordfish. The model incorporates a feature that allows the mercury discovery to affect the demand for swordfish in the year that it was discovered and subsequent years. However, as time progresses, the model allows the impact of the mercury discovery to lessen as consumers forget<sup>1</sup>. Thus, the model is used to make projections in a period where mercury levels are no longer perceived as a factor in swordfish demand.

## The U.S. Swordfish Market, 1965-70

Prior to 1971, the U.S. swordfish mar-

ket was dominated by imports which totaled over 7 million pounds of fillets and steaks a year (Fig. 1). On the other hand, U.S. landings were typically below 2 million pounds (round weight) annually. Because the market was dominated by imports, it is not surprising that ex-vessel prices moved in proportion to import prices. Both import and ex-vessel prices showed a slightly increasing trend over the period (Fig. 2). World swordfish landings during the period rose from about 32,000 metric tons (t) in 1965 to 38,000 t in 1970 (Fig. 3). U.S. landings made up only 4 percent of world landings in 1965, and fell to 1 percent by 1970.

In terms of consumption, the U.S. population consumed between 16 and 18 percent of the world swordfish production during the period. U.S. per capita consumption totaled between 0.04 and 0.05 pounds of swordfish per year (Fig. 4).

## The U.S. Swordfish Market, 1971-80

In 1971, concentrations of mercury exceeding the U.S. Food and Drug Administration's (FDA) action level of 0.5 ppm were found in swordfish (D'Itri and D'Itri, 1977). Swordfish that were either imported or transported interstate were subjected to FDA inspection and possible seizure if found to exceed the action level. News reports warned consumers of the dangers of eating swordfish with high mercury concentrations. As a result, swordfish consumption dropped 96 percent to less than 0.002 pounds per capita in 1971. By 1980, per capita swordfish consumption had rebounded to about 0.03 pounds.

Swordfish imports plummeted from

almost 8.8 million pounds in 1970, to 169,000 pounds in 1971. U.S. landings also fell from almost 1.6 million pounds (round weight) in 1970 to only 233,000 pounds in 1971.

In 1977, no swordfish imports were reported, but by 1980, imports had risen to 478,000 pounds. The rebound in U.S. landings was rapid and dramatic, reaching 1.5 million pounds in 1973 and topping 9.1 million pounds in 1980.

To understand the growth in U.S. landings of swordfish, it is helpful to examine what happened to swordfish prices from 1971 to 1980 (Fig. 2). Despite discovery of the mercury problem, real ex-vessel price for swordfish actually increased 5 percent in 1971, over 50 percent in 1972, and another 15 percent in 1973. In 1974, ex-vessel price adjusted downward 32 percent, rebounded a little in 1975, and remained flat through the remainder of the decade.

At the same time that ex-vessel prices were increasing, import prices were decreasing. Real import prices fell 11 percent in 1971 and an additional 42 percent in 1972. The requirement for inspection of imported swordfish for mercury had differentiated the imported and domestic product. Domestic swordfish landed and marketed in the same state were not subject to FDA inspection and seizure, even though the mercury levels might exceed the FDA action level. Thus, seafood dealers had a higher demand for swordfish that could be landed and marketed in the same state relative to imported swordfish or swordfish that had to be transported across

<sup>1</sup>See Swartz and Strand (1981) for a similar analysis of the effect of news of Kepone contamination on oyster prices.

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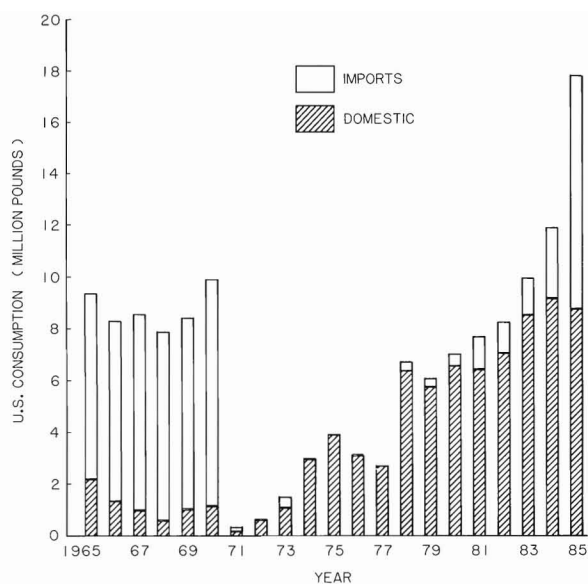


Figure 1.—U.S. consumption of swordfish by source.

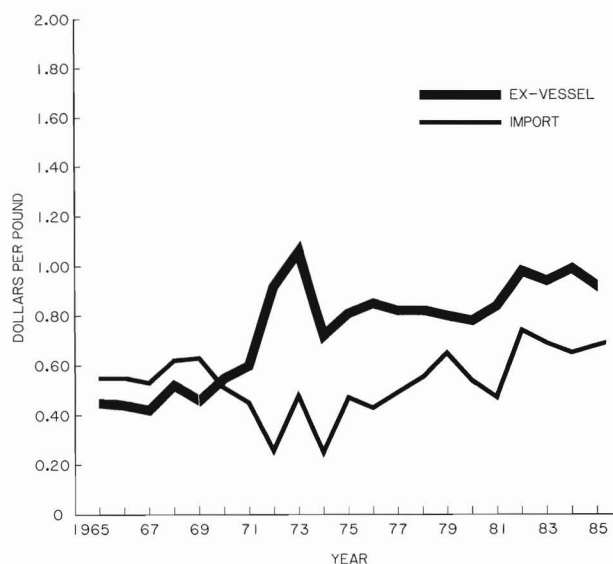


Figure 2.—Real ex-vessel and import swordfish prices, 1965-85 (deflated by producer price index for all products; 1967 = 100).

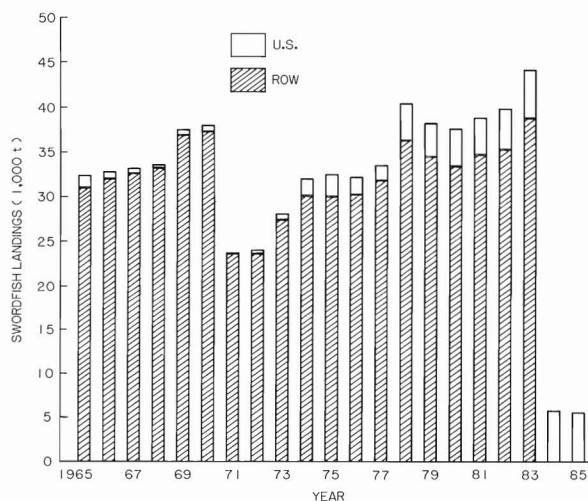


Figure 3.—U.S. and rest of world (ROW) swordfish landings, 1965-85. ROW landings unavailable for 1984-85.

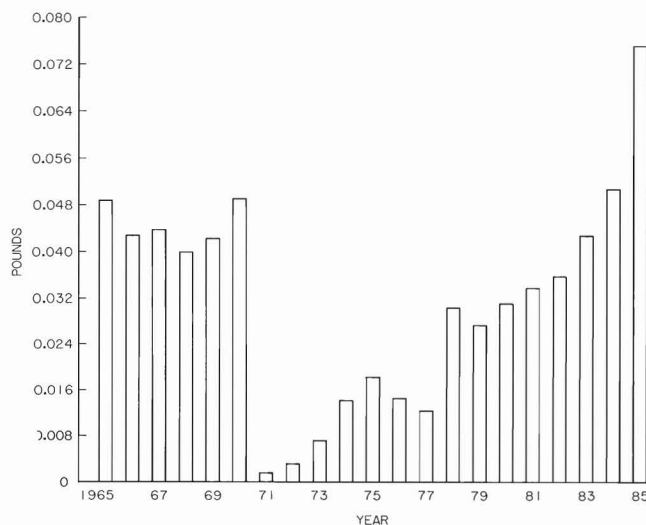


Figure 4.—U.S. per capita consumption of swordfish, 1965-85.

state lines. This demand differential was reflected in the difference in ex-vessel and import prices. U.S. fishermen responded to these price signals by increasing their production of swordfish.

From 1975 to 1980, import prices slowly regained ground lost from the 1971 mercury discovery, but import quantities barely recovered.

The entire world market was affected

by the mercury problem. World landings dropped 37 percent in 1971. By 1980, the U.S. accounted for 11 percent of the world swordfish catch and 12 percent of its consumption.

## The Swordfish Market, 1980-86

The upward trend in U.S. landings begun in the mid-1970's has continued to the present (1986). Imports, however, recovered slowly until 1985 when they increased 330 percent over 1984 levels. However, the 1985 total was still only 3 percent higher than in 1970. The increase in imports was accompanied by a 5 percent rise in real import price, which includes the effect of the dollar exchange rate. Thus, the rise in the value of the dollar, which makes imports cheaper, cannot account for the increase in imports. It is more likely that there has been a surge in demand for high value fishery products such as shrimp, fresh salmon, fresh tuna, and swordfish. This is further substantiated by the fact that preliminary data through May 1986 show swordfish imports up 75 percent over the same period in 1985 despite a 10 percent rise in real import price. Another explanation for the increase in imports may be due to mistakenly including transshipments of swordfish caught by U.S. fishermen through foreign countries in the import statistics. However, since these transshipments are not counted as U.S. landings, the overall effect of increased swordfish supply on the U.S. market is unchanged.

Per capita swordfish consumption increased steadily over this period from about 0.03 pounds per person in 1980 to just over 0.05 pounds in 1984, then took a big jump to almost 0.08 pounds per person in 1985. This increase in per capita consumption in 1985 was accompanied by an 11 percent decrease in real swordfish price<sup>2</sup>. Until landings data become available, it is not possible to determine whether the continued surge in imports in 1986 is being partially fueled by a decline in domestic landings. If domestic landings remain at levels similar to the most recent 3 years, and imports continue to arrive at a pace 75 percent ahead of 1986, per capita consumption in 1986 would be 0.1 pounds, a 25 percent increase over 1985.

Data for world swordfish landings are

not available after 1983. If world landings in 1985 are similar to 1983 levels, then U.S. consumption accounted for an estimated 25 percent of the world's swordfish in 1985.

## The Swordfish Market

### Forecasting Equation for Swordfish Demand

The equation used for forecasting swordfish demand was estimated using the Shiller polynomial distributed lag (Judge et al., 1985). The lagged variable was a dummy variable equal to one in the year 1971 when high concentrations of mercury were discovered in the swordfish, and zero for all other years. The lag periodicity chosen was 5 years including the current year, and a first-degree smoothness prior was chosen. Other variables included were swordfish price (a weighted average of import and ex-vessel prices), per capita disposal income, and the consumer price index for the substitute product, beef. All variables were adjusted for inflation and regressed on the natural logarithm of per capita swordfish consumption.

The above model performed well in regard to expected signs and the overall significance level; however, the largest residuals were obtained for the most recent years (1985-86), where per capita consumption was underestimated. It appears that a structural shift has increased the demand for swordfish, and this was modeled by including another dummy variable set at one for 1985 and 1986, and zero for all other years. This model performed much better in predicting the most recent data, and it is felt, gives more reasonable forecasts. The coefficients of the forecasting equation and associated t-statistics are given in Table 1. All coefficients had expected signs. The  $r^2$  for the equation was 0.91.

### Swordfish Market Projections

Details on the model used to make projections about the U.S. swordfish market have already been given. Per capita consumption of swordfish is assumed to be a function of real swordfish price, real per capita disposal income, and the extent of knowledge

Table 1.—Coefficients and t-statistics of swordfish demand for forecasting equation.

Variable	Coefficient	t-Statistic
Constant	-7.25	-2.59
Swordfish price	-0.61	-0.43
Per capita disposable income	$1.9 \times 10^{-4}$	0.83
CPI for beef	2.43	1.56
Dummy for mercury (D)	-3.19	-7.33
D(-1)	-2.51	-6.01
D(-2)	-1.81	-4.28
D(-3)	-1.08	-3.13
D(-4)	-0.40	-1.04
Dummy for structural change	1.04	2.72

Table 2.—Projection of per capita consumption (PCCONS), total consumption (TCONS) and imports of swordfish.

Year	PCCONS (lb.)	TCONS (10 <sup>3</sup> lb.)	IMPORTS (10 <sup>3</sup> lb.)
1985 <sup>1</sup>	0.075	17,808	9,052
1986	0.086	20,778	12,723
1987	0.091	22,274	13,702
1988	0.095	23,411	14,840
1989	0.098	24,298	15,727
1990	0.102	25,712	17,141
1991	0.108	27,168	18,597
1992	0.112	28,554	19,983
1993	0.116	29,799	21,228
1994	0.119	30,756	22,185
1995	0.122	31,820	23,249

regarding the levels of mercury found in swordfish. In 1971, mercury contamination of swordfish was headline news, but over time it appears that people have forgotten about the mercury levels. The model used allows the separation of price and income effects on swordfish consumption from the effects of the mercury scare. Thus, changes forecast in the economy through the disposable income variable can be used to forecast changes in per capita swordfish consumption. Population forecasts are then used to convert per capita swordfish consumption to total consumption.

The model forecasts that with no change in real swordfish price, per capita consumption in 1986 will be 0.09 pounds, slightly less than the 0.1 pounds predicted if imports continued at the rate they did through May 1986 (Table 2). Between 1988 and 1990 per capita consumption will reach 0.1 pounds, and by 1995 it will reach 0.12 pounds. Because of population growth, this means that 25.7 million pounds of swordfish will be

<sup>2</sup>An index of swordfish price which is a weighted average of import and ex-vessel price is used here.

consumed in 1990, and 31.8 million in 1995 compared with the 18 million pounds in 1985. With U.S. catch in round weight remaining around the 12 million pounds mark, imports in 1990 will be 17.1 million pounds, and in 1995, 23.2 million pounds, 89 and 156 percent increases over the 1985 import level, respectively.

The above estimates assume no change in real swordfish price from the predicted 1986 price. If, however, the U.S. dollar exchange rate with the swordfish exporting countries were to change, the predictions would shift accordingly. A further devaluation of the dollar would make swordfish imports more expensive, lowering per capita consumption and total imports. A rise in the value of the dollar would have the opposite effect. However, the price effects are small. At the 1986 values, a 1 percent rise (decline) in swordfish price will lower (raise) per capita consumption less than 0.5 percent.

### Summary and Conclusions

In 1986, the U.S. swordfish market overcame the weakness in demand created by the discovery of high concen-

trations of mercury, and consumption was at record levels. In the 1960's the swordfish market was dominated by imports, but today a substantial portion of the supply is from domestically caught swordfish. This analysis has shown that the FDA regulations for inspection of imported swordfish and the likelihood of seizure of contaminated products, created an opportunity for the development of the U.S. fishery. Higher prices for domestic swordfish sparked an increase in investment in the U.S. fishery. As consumers forgot about the mercury issue, swordfish demand increased, allowing further expansion of the domestic harvest and the slow return of imports. In 1985 and 1986, seafood demand in general appears to be up due to rising consumer incomes, the related increase in away-from-home food purchases, and the image of seafood as a healthy food. Swordfish is benefitting greatly from this new surge in demand.

The outlook for the swordfish market looks bright. As consumer incomes continue to rise and the U.S. population grows, both domestic fishermen and importers can expect continued high prices as demand for swordfish increases. The one major unknown in the future of the

market is the mercury issue. Inquiries with FDA indicate no change in their enforcement of the 1.0 ppm methyl mercury action level. Thus, it may be that more swordfish is being landed with mercury levels lower than in the past. No studies have been conducted to determine if this is true. Relatedly, the 1.0 ppm action level was partially based on the fact that per capita consumption was greatly reduced due to consumer awareness of high levels of mercury in swordfish. The present and projected higher per capita consumption levels might induce the FDA to reexamine the 1.0 ppm action level for mercury in swordfish. If this were to occur, swordfish consumption would be expected to fall due to the effect of negative publicity on demand and the effect of the higher action level on supply.

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